

**A PILOT STUDY ON THE MEDICAL COSTS ANALYSIS OF THE
TEN LEADING CANCERS BY ORGAN SITE IN GUAM, USA:
*Findings from the Medicaid-MIP Data, 2007-2011***

Abstract

Background: No study has assessed the direct cost of medical services on Medicaid-MIP beneficiaries with cancer in Guam. This information is essential for understanding the cost of cancer care to the Medicaid-MIP program, given that cancer is the 2nd leading cause of death on the island.

Research Design: Based on the updated 2013 Guam Cancer Registry data, the 10⁽¹⁾ leading forms of cancer by organ site from 2007 to 2011 were identified. Administrative data from the Guam DPHSS Bureau of Health Financing Medicaid-MIP Program was used to identify new cancer cases based on the registry ⁽²⁾. Annual prevalence rates were computed. Medical services were disaggregated into on-island outpatient and inpatient services as well as off-island services. Direct costs of services were adjusted for comparability and a cost projection was done.

Results: Six hundred twenty new cancer diagnoses were recorded between 2007 and 2011. Breast Cancer, Prostate and Lung Cancer were the three leading forms followed by Lung, Colon, Reticulo-Endothelial System (RES), Cervical, Lip-Oral-Tongue-Pharyngeal (LOTP), Liver, Thyroid and Stomach Cancers. It is projected that from 2016 to 2020, based on physician's charges, and after adjusting cost of services, the government of Guam will spend approximately between \$147,203.90 and \$153,516.90 annually for on-island direct medical services for the ten leading cancer types. RES Cancers have the highest on-island inpatient medical service cost while Stomach Cancer has the highest on-island outpatient medical service cost.

Conclusion: This study has shown the past, current and future economic impact of the cost of medical services on cancer care among Medicaid-MIP beneficiaries in Guam. The projected cost reflects the cost of services available locally.

Introduction

Based on the latest 2013 Guam Cancer Registry, Lung, Prostate and Breast Cancers are the three leading causes of cancer in Guam(1). Between the years 2003 and 2007, 1,580 new cancer cases and 720 deaths were recorded by the registry on Guam. In 2010, cancer was the second cause of death among Guamanians; heart disease being the first. Needless to say, cancer remains to be a public health priority. On Guam, the burden of cancer is aggravated by challenges such as limited treatment options; the high costs associated with off-island care, and limited insurance coverage. These characteristics are truly unique of the island populace. To put into perspective the government's efforts in decreasing the impact of cancer in the society, public health systems across the globe have embarked on economic cost studies in order to quantify and analyze the burden of a particular disease in the community (2). Data from these studies are also vital in estimating and projecting future economic impact in disease management.

In the midst of the economic challenge that Guam is facing today, it is only befitting that all the stakeholders in the health care system – policymakers, insurers, health care providers and the consumers – need objective, science-based information to help them make critical decisions on how to allocate scarce health care resources.

To date, no local studies have been made in Guam on the economics of cancer care.

The primary objective of this study is to identify the various medical services and the attendant physician charges and actual reimbursed amount in the management of the ten leading cancers in Guam from 2007-2011. With these variables, the study also aims to quantify the current cost and project the anticipated economic impact of cancer care in the next 5-10 years.

Methodology

Information on the ten leading cancers by organ site was gathered based on the latest figures from the Guam Cancer Registry. Using this data, administrative records were reviewed from the Guam Department of Public Health and Social Services Bureau of Health Financing (DPHSS-BHF) Medicaid-MIP Program beneficiaries. Records of newly diagnosed cancer cases (Primary Diagnosis) were identified using the ICD 9 Code claim, each year from 2007-2011.

The annual prevalence rate for each cancer was calculated by the following:

Annual Prevalence Rate:

$$\frac{\text{Sum of number of cases for each cancer per year (i.e. 2007-2011)}}{\text{Total number of cancer patients per year}} \times 100$$

Annual number of cancer patients was obtained from the Guam DPHSS Bureau of Health Financing. For cervix and prostate cancers, gender specific annual number of cancer patients (i.e. female for cervix and male for prostate) was used to calculate prevalence.

Demographic characteristics such as age, gender and ethnicity were likewise collected and analyzed using rates and proportions.

The raw and the adjusted annual costs for physician charges and insurance payment were computed for each cancer type. Adjustments were made in order to make the costs comparable over time. Moreover, these costs were disaggregated by service types (i.e. on-island inpatient, on-island outpatient and off-island services). The average raw and adjusted annual costs for physician charges and insurance payments per specific cancer are presented as bar charts. These were computed by dividing the total raw and projected annual costs per year by the number of cases per year.

In preparing for the projection estimation, the number of cases per specific cancer per year were plotted to determine the distribution of cases across the five-year period.

Based on the scatter plots, the distribution did not approach a linear relationship.

The moving averages of the adjusted costs for physician charges and insurance payments per specific cancer were then used in the computation.

The four moving averages were inputted into a non-linear regression model to estimate projection in US Dollars. Moreover, projected population of Guam from 2014 to 2030 was also included in the projection estimation. The projected population was taken from Guam Statistics (4).

The non-linear regression procedures of Seber and Wild (1989) and Meade and Islam (1995) were followed. In this procedure, the moving averages were independent variables (7) (8). In getting the estimate for the burden of cancer, the annual prevalence rates were considered as independent variables. The coefficient for the moving averages from the non-linear regression was used as slope in the calculation of the cost estimate. The projected number of cases of cancer was multiplied to the cost estimate to determine the annual burden of cancer.

Definition of Terms

Physician's Charges include costs of all hospital (Guam Medical Hospital) and outpatient clinic, medications, in and outpatient laboratory services, medical supplies and equipment charged by corresponding physicians and other service providers.

Medicaid-MIP Payments are the actual costs contributed or paid by Medicaid-MIP for a particular service. Depending where the service was performed, the type of service (**Service Type**) may either be On-island or Off-island. Considering the fluctuating characteristics of the costs of services, the moving averages for the years 2007-2011 were calculated and used. The result from this represents the cost (physician charges and insurance payment) of specific cancer per person per year. The 2013 Consumer Price Index (CPI) was used to make the data comparable with 2013 US dollars. Regression analysis was done to derive a six year projection on the cost of cancer care for each type of cancer. The cost projection was calculated by taking the slope of the prevalence proportion for the year 2007 to 2011. **Direct costs** include the cost of the goods, services, and other resources consumed in the provision of an intervention or in dealing with the side effects or other current and future consequences of which medical services is a prime example (9).

Results

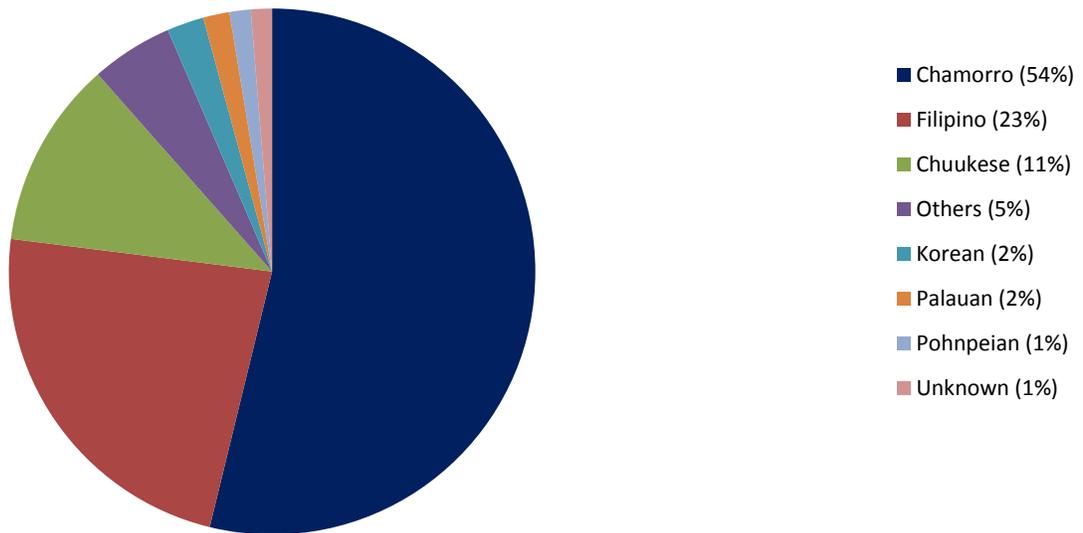
A total of 620 records of newly diagnosed cancer cases (primary diagnosis) were retrieved from the BHF Combined Medicaid-MIP data base from 2007 to 2011. Of these, there were 330 (53%) females and 290 (47%) males. The median age of patients at the time of diagnosis was 48 years (range 1-99 years). Majority of patients were 16 years old and above (601/620 or 97%).

The majority of cases were Chamorros (332/620 or 54%) followed by Filipinos (143/620 or 23%), Chukese (71/620 or 11%), and Others (31/620 or 2%).

There were a total of 44,179 individual medical services on record between 2007 and 2011. Of these, 42,064 (95%) were obtained on-island and the remaining 2,113 (5%) services were off-island. The 5-year actual total cost of medical services amounted to \$20,570,387. The 5-year total cost of on-island medical services was \$13,252,090. Most of these were non-hospital admissions or those considered as cancer clinic or PCP follow-up visits (\$7,251,844) while inpatient medical services or hospital admission cost \$6,000,246.

The 5-year off-island medical services (2,133 or 5% as mentioned above) totaled \$7,318,297 which was mostly hospital admissions for further diagnostic work-up and or therapy. Cost adjustment and cost projection on physician’s charges and Medicaid-MIP payments were done on on-island services. Due to inadequate available data on record, cost adjustment and cost projection were not done on off-island services.

Fig 1. Distribution of Cancer Cases by Ethnicity
Medicaid-MIP Participants, 2007-2011 (N=620)



Source: Medicaid-MIP Data Set, BHF DPHSS, Guam, 2007-2011

Table 1 shows the prevalence rates of the ten leading cancers by organ site among Medicaid-MIP participants from 2007 to 2011. Breast cancer was the leading form of cancer followed by Prostate, Lung, Colon and cancers originating from the RES (Reticulo-Endothelial System e.g. the Leukemias and Lymphomas).

Table 1. Annual Prevalence Rates of the 10 Leading Cancers by Site

Medicaid-MIP Participants, 2007-2011 (per 1,000 cancer patients)

Type	2007	2008	2009	2010	2011	2007-2011
Breast ^a	383.0	166.7	191.9	95.7	201.4	204.2
Prostate ^b	272.7	206.9	153.8	83.3	170.5	167.6
Lung	118.4	125.0	96.4	115.4	96.4	108.4
Colon	105.3	90.3	71.1	91.3	76.3	85.3
RES ^c	125.0	62.5	30.5	81.7	88.4	76.8
Cervical ^a	53.2	27.8	111.1	34.8	122.3	75.1
LOTP ^d	105.3	34.7	40.6	24.0	48.2	48.4
Liver	46.1	76.4	35.5	57.7	68.3	56.8
Thyroid	78.9	6.9	40.6	28.8	28.1	35.8
Stomach	26.3	20.8	35.5	28.8	24.1	27.4

^a per 1000 female cancer patients; ^b per 1000 male cancer patients; ^cRES: Reticulo Endotheleal System (e.g. Leukemias, Lymphomas, etc);

^dLOTP: Lips, Oral Cavity, Tongue, Pharynx

Source: Medicaid-MIP Data Set, BHF DPHSS, Guam, 2007-2011

Adjusted Physician's Charges and Medicaid-MIP Payments

Figure 2 to Figure 10 show the Adjusted Physician's Charges and Insurance Payment of medical services of the ten leading cancers per patient in Guam for Medicaid and MIP participants from 2007-2011. Based on the data, costs of off-island medical services were comparably higher for all cancer types compared to on-island medical services while Physician's Charges were generally higher than Medicaid-MIP payments for both outpatient and inpatient medical services. The total 5-year adjusted cost of medical services based on physician's charges for the 10 leading cancer types amount to \$197,285.

Figure 2. Adjusted Physician's Charges and Insurance Payments for Breast Cancer

by Service Type Medicaid-MIP Participants 2007-2011, Guam, USA (in US\$)

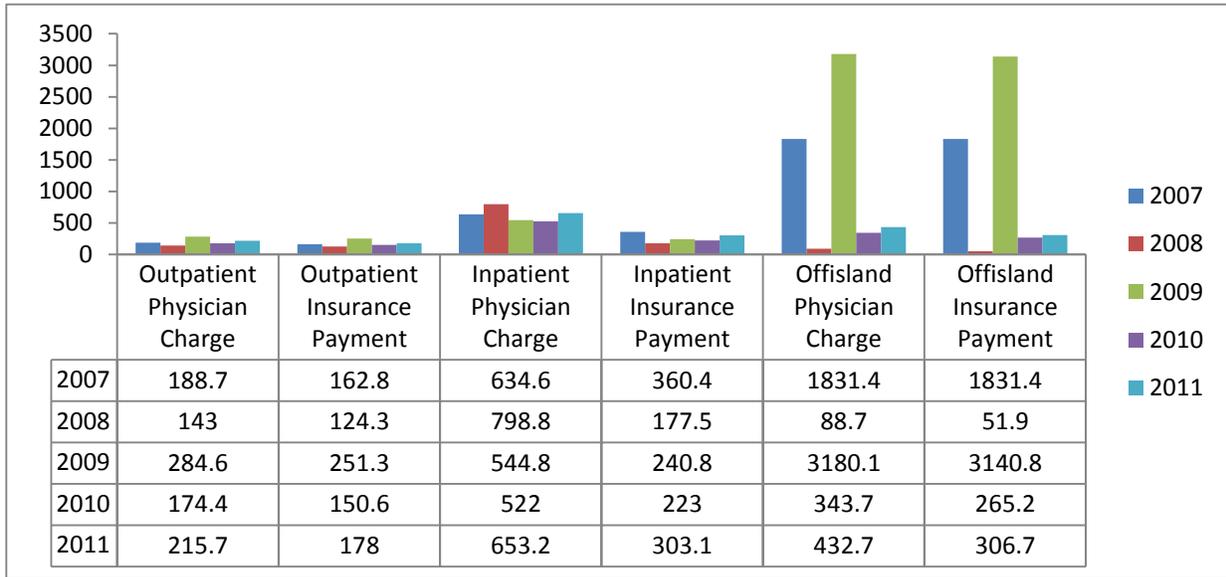


Figure 2 shows the physician’s charges and insurance payment for Breast Cancer by service type from 2007 to 2011. For on-island services, in-patient cost is higher compared to out-patient cost while off-island cost is generally higher. Off-island costs of medical services were generally higher in 2009.

Figure 3. Adjusted Physician’s Charges and Insurance Payment for Lung Cancer by Service Type Medicaid-MIP Participants 2007-2011, Guam, USA (in US\$)

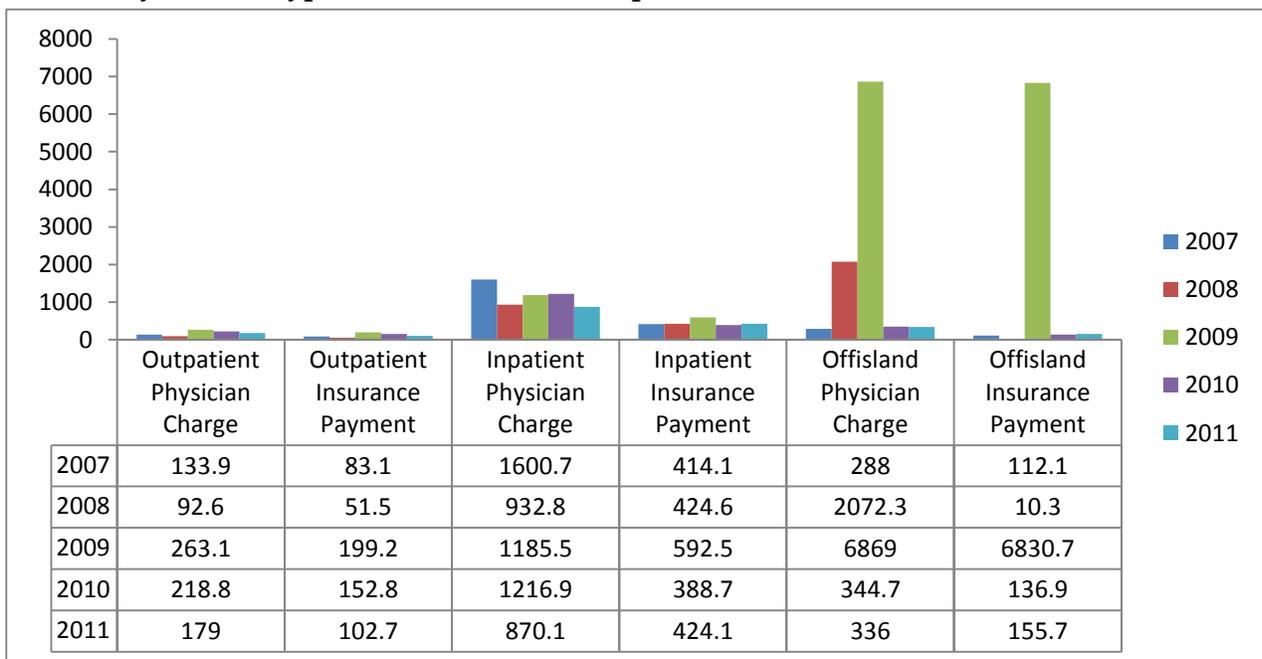
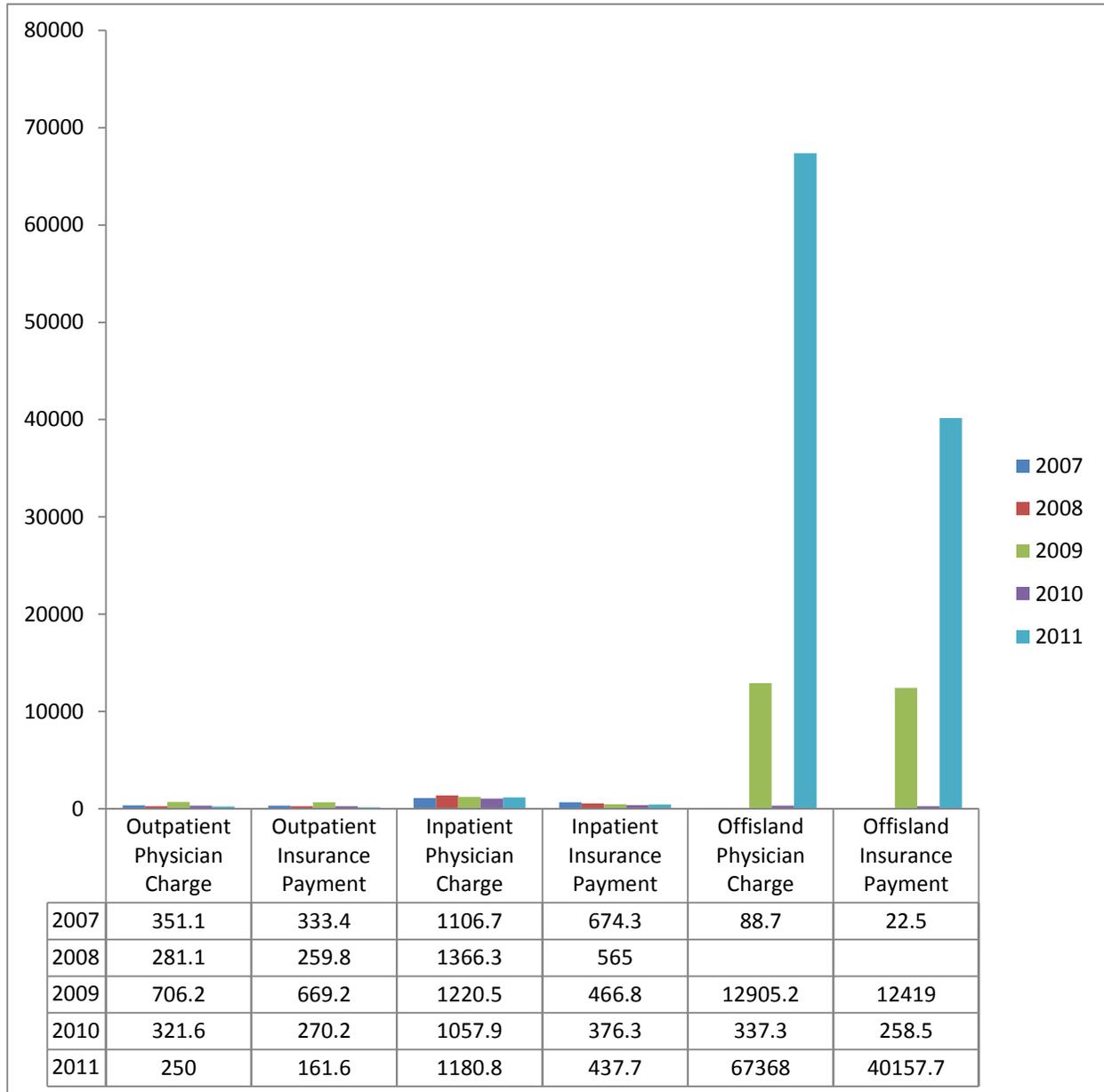


Figure 3 shows the physician’s charges and insurance payment for Lung Cancer by service type from 2007 to 2011. For on-island services, in-patient cost is higher compared to out-patient

cost while off-island cost is generally higher. Off-island costs for medical services were high in 2009.

Figure 4. Adjusted Physician’s Charges and Insurance Payment for Colon Cancer by Service Type Medicaid-MIP Participants 2007-2011, Guam, USA (in US\$)



Data available for 2008 off-island charges were not enough to perform cost adjustment

Figure 4 reflects the physician’s charges and insurance payment for Colon Cancer by service type from 2007 to 2011. For on-island services, in-patient cost is higher compared to out-patient cost while off-island cost is generally higher. Data showed off-island medical costs were highest

in 2011. Cost adjustment was not performed for 2008 due to inadequate available data on record.

Figure 5. Adjusted Physician’s Charges and Insurance Payment for RES Cancer by Service Type Medicaid-MIP Participants 2007-2011, Guam, USA (in US\$)

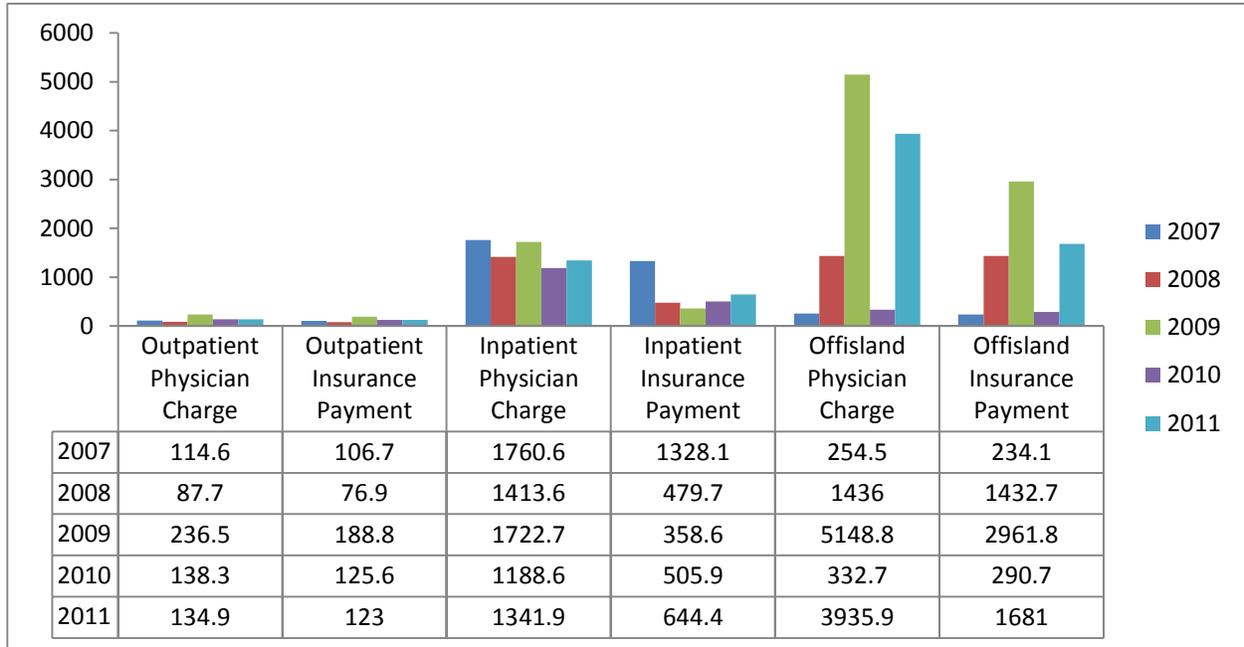
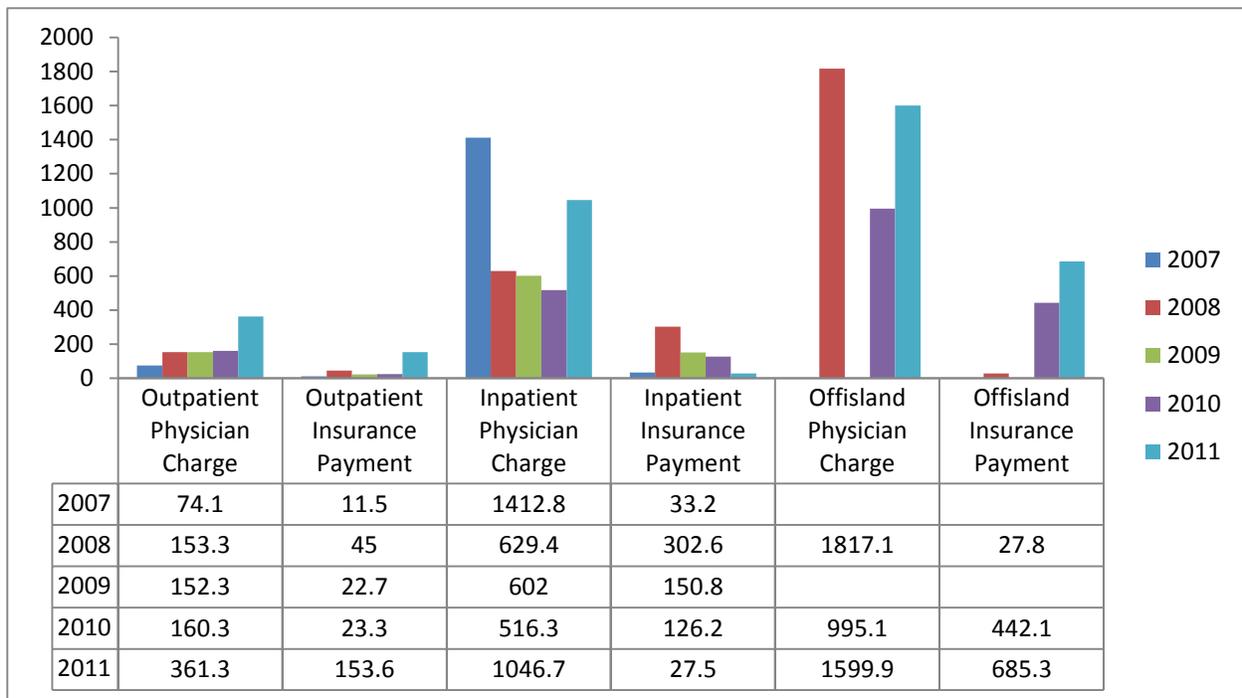


Figure 5 shows the physician’s charges and insurance payment for Reticulo-Endothelial System (RES) Cancer by service type from 2007 to 2011. For on-island services, in-patient cost is higher compared to out-patient cost while off-island cost is generally higher. RES Cancers include the Leukemias and Lymphomas. Among the 10 cancers, RES Cancers have the highest In-patient physician charges reflecting the amount of medical services recorded.

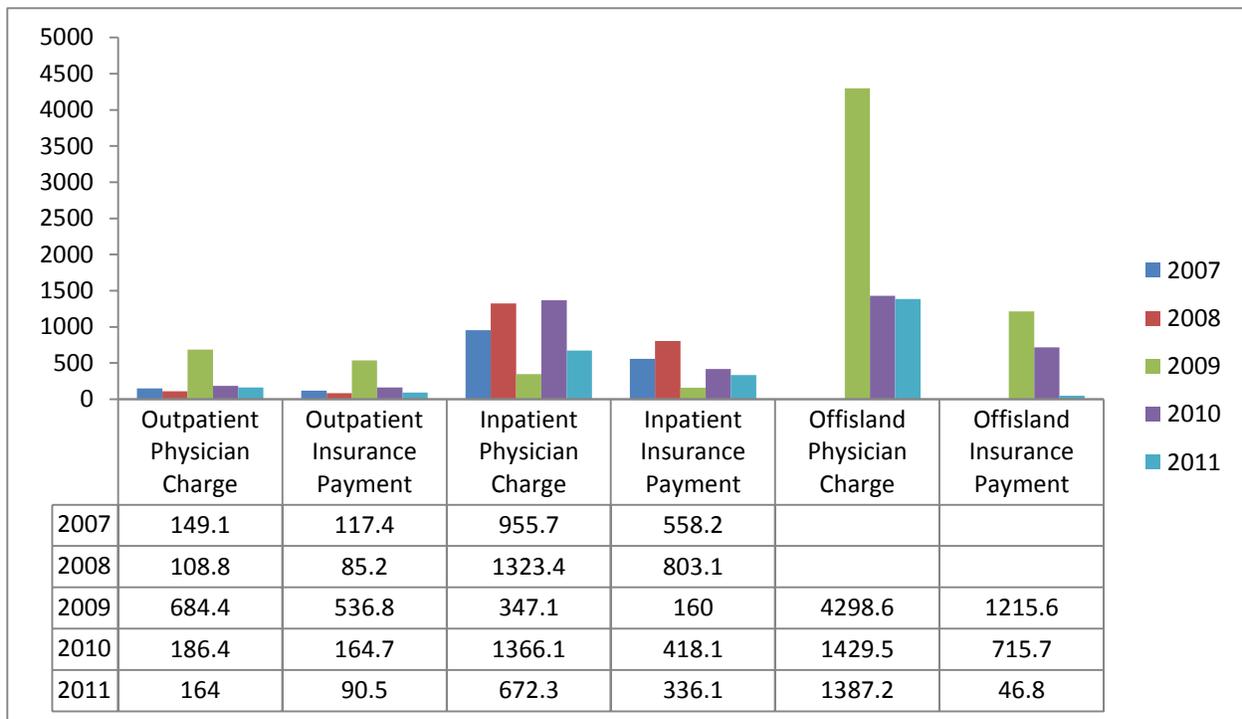
Figure 6. Adjusted Physician’s Charges and Insurance Payment for Prostate Cancer by Service Type Medicaid-MIP Participants 2007-2011, Guam, USA (in US\$)



Data points for 2007 and 2009 off-island charges were not enough to perform cost adjustment

Figure 6 illustrates the physician's charges and insurance payment for Prostate Cancer by service type from 2007 to 2011. For on-island services, in-patient services cost is higher compared to out-patient cost while off-island cost is generally higher. Cost adjustment was not performed for 2007 and 2009 due to inadequate available data on record.

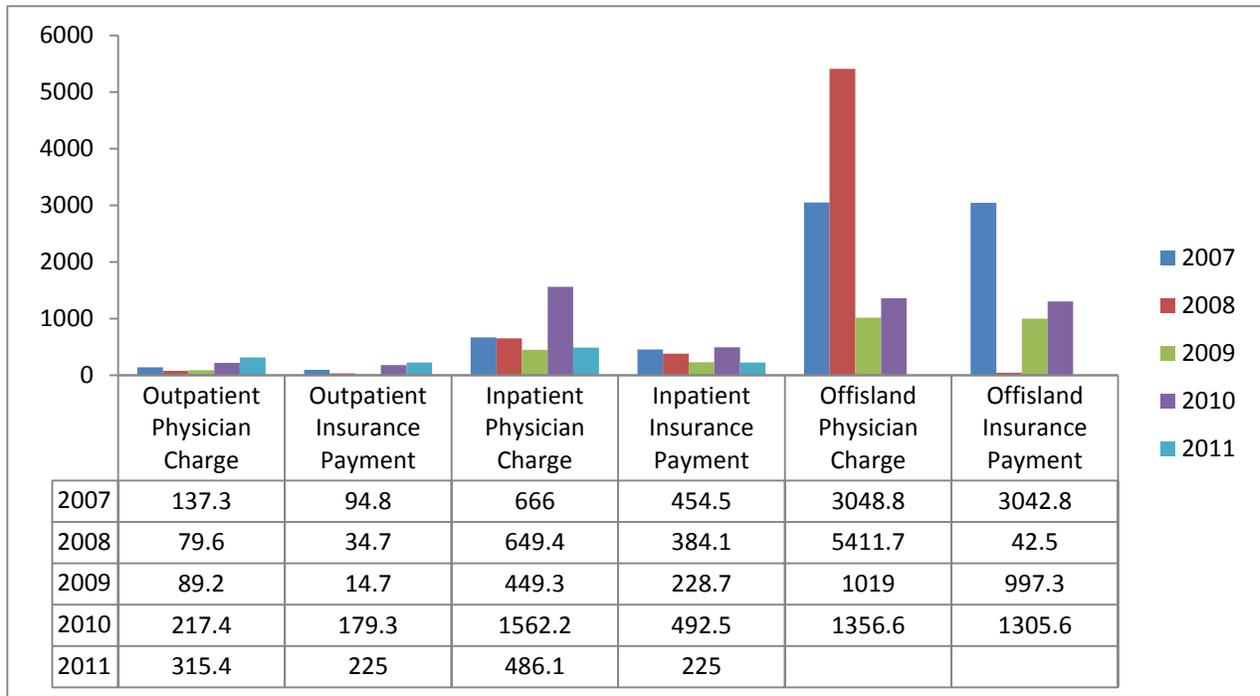
Figure 7. Adjusted Physician's Charges and Insurance Payment for Liver Cancer by Service Type Medicaid-MIP Participants 2007-2011, Guam, USA (in US\$)



Data points for 2007 and 2008 off-island charges were not enough to perform cost adjustment

Figure 7 shows the physician's charges and insurance payment for Liver Cancer by service type from 2007 to 2011. For on-island services, in-patient cost is higher compared to out-patient cost while off-island cost is generally higher. Cost of off-island services was high in 2009. Cost adjustment was not performed for 2007 and 2008 due to inadequate available data on record.

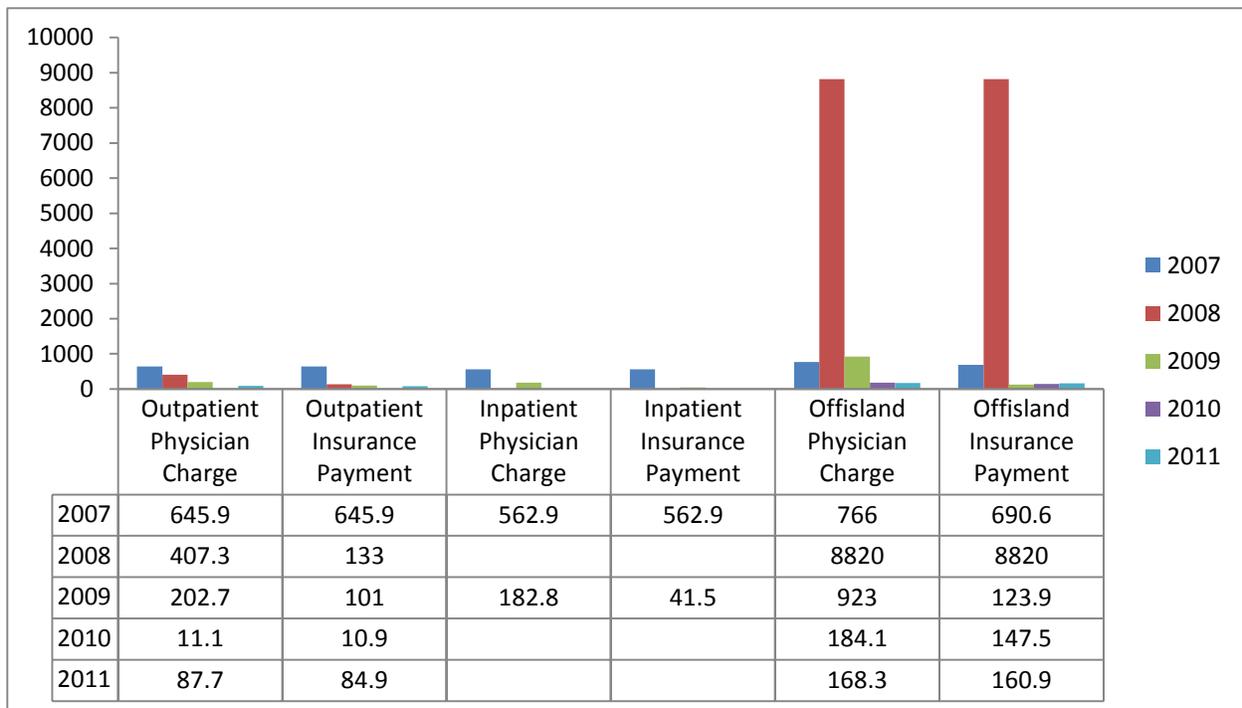
Figure 8. Adjusted Physician's Charges and Insurance Payment for LOTP Cancers by Service Type Medicaid-MIP Participants 2007-2011, Guam, USA (in US\$)



Data points for 2011 off-island physician charges and insurance payments were not enough to perform cost adjustment; LOTP (Lip, Oral Cavity, Tongue, Pharynx)

Figure 8 displays physician’s charges and insurance payment for LOTP Cancer by service type from 2007 to 2011. For on-island services, in-patient cost is higher compared to out-patient cost while off-island cost is generally higher. 2008 registered the highest off-island physician charges for medical services obtained. Cost adjustment was not performed for 2011 off-island physician charges and insurance payment due to inadequate available data on record.

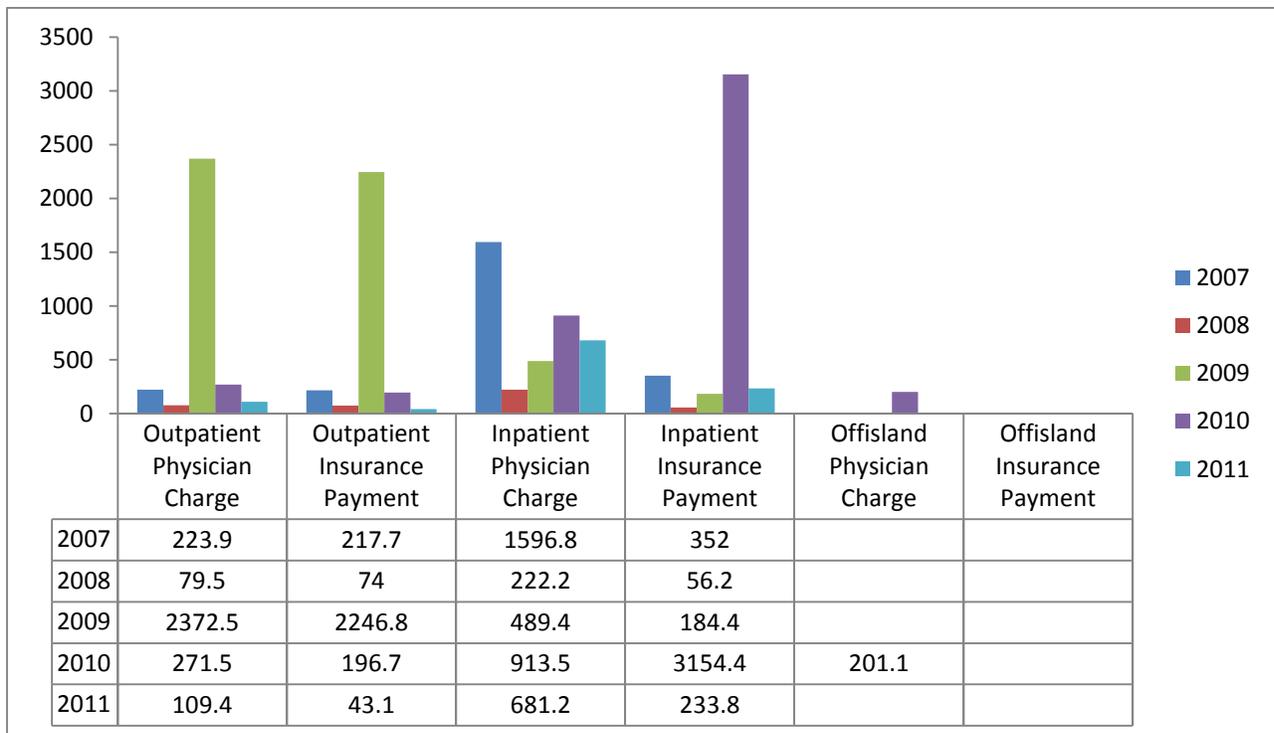
Figure 9. Adjusted Physician’s Charges and Insurance Payment for Cervical Cancer by Service Type Medicaid-MIP Participants 2007-2011, Guam, USA (in US\$)



Data points for 2008, 2010 and 2011 on-island physician charges and insurance payments were not enough to perform cost adjustment

Figure 9 shows the physician’s charges and insurance payment for Cervical Cancer by service type from 2007 to 2011. For on-island services, in-patient and out-patient cost while off-island cost is generally higher. Data shows that in 2008, cost of off-island medical services was high. Cost adjustment was not performed for 2008, 2010 and 2011 on-island physician charges and insurance payment due to inadequate available data on record.

Figure 10. Adjusted Physician’s Charges and Insurance Payment for Stomach Cancer by Service Type Medicaid-MIP Participants 200 7-2011, Guam, USA (in US\$)



Data points for 2007, 2008, 2009 and 2011 off-island physician charges and insurance payments were not enough to perform cost adjustment

Figure 10 displays the physician’s charges and insurance payment for Stomach Cancer by service type from 2007 to 2011. Unlike the majority of the 10 cancer types, most services were obtained on-island. Outpatient cost was highest in 2009 while in-patient insurance payment was highest in 2010. Cost adjustment was not performed for 2007, 2008, 2009 and 2011 due to inadequate available data on record.

Projected Physician’s Charges and Insurance Payment for Medical Services

Figure 11 to Figure 12 illustrate the projected Physician’s Charges for Outpatient and Inpatient medical services, respectively. No observable pattern of correlation was noted in the data thus, non-linear regression was utilized in the analysis.

Figure 11. Projected Outpatient Physician’s Charges per Patient By Cancer Type, 2012-2030 (in US\$)

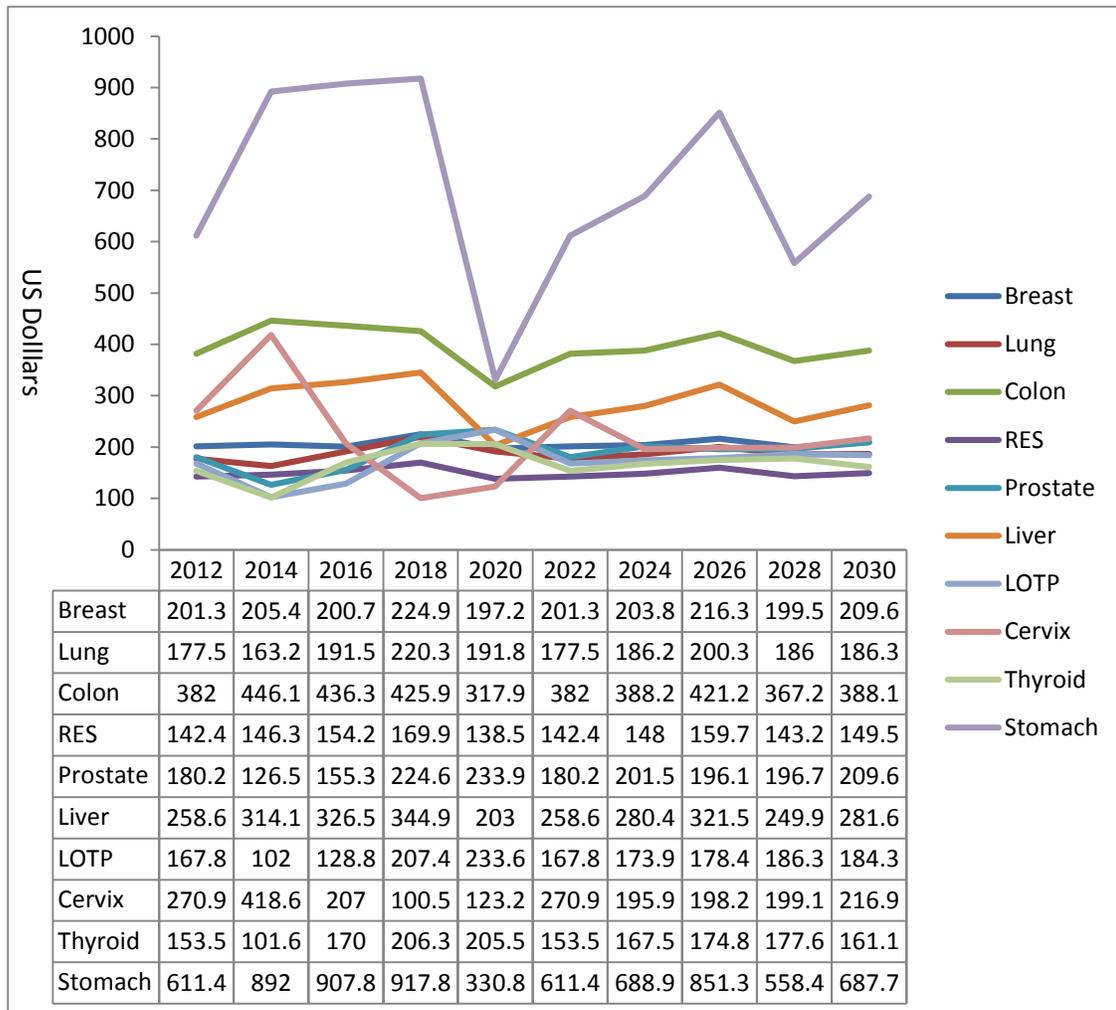


Figure 11 above shows a 18-year projection (2012-2030) of Physician’s Charges per patient per year for outpatient medical services among the 10 leading causes of cancer by site using the Medicaid-MIP data set. In this particular study where the moving averages of costs of services were utilized in performing cost projection, the yearly disease prevalence rate and adjusted cost are of particular importance. The table shows that stomach cancer leads the cost of projected physician’s charges for 2012-2030.

This explains the dip in 2020 of \$331 from \$918 in 2018. In general however, the projected physician’s charges for outpatient medical services of the remaining nine cancer types fall between \$100 and \$500.

Figure 12. Projected Inpatient Physician Charges per Patient By Cancer Type, 2012-2030 (in US\$)

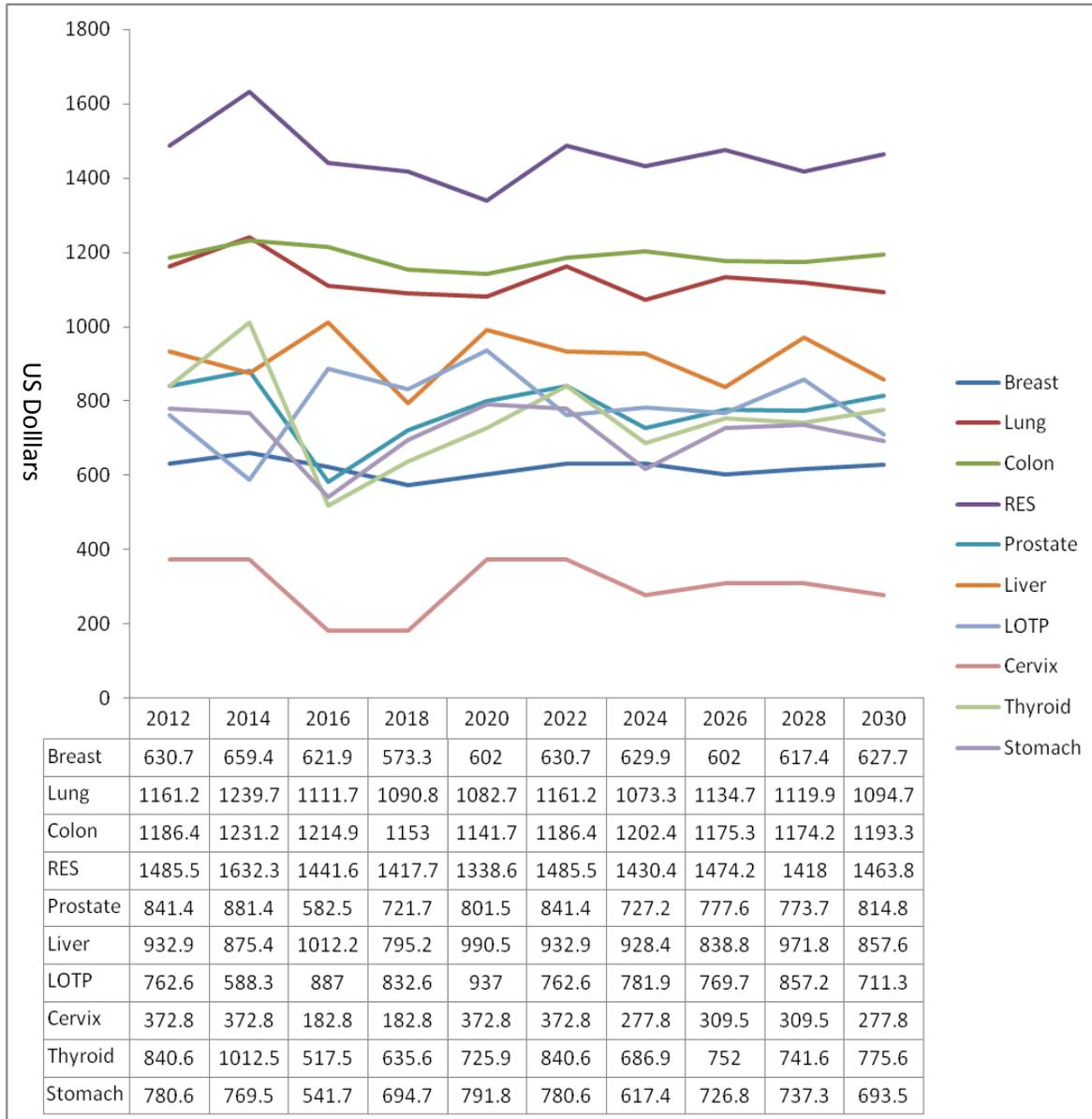


Figure 12 shows the 18-year (2012-2030) projected cost of Physician’s Charges per patient per year for inpatient medical services based on the Medicaid-MIP data set. RES Cancer are projected to have higher inpatient cost of medical services compared with other cancer types; the lowest being Cervical cancer. Projected physician’s charges for inpatient medical services of the remaining cancer types range between \$600 and \$1,200.

**Table 2. Projected^d Combined Outpatient-Inpatient Physician Charges
Per Patient by Cancer Type, 2012-2030 (in US\$)**

Year	Cancer Type										
	Breast	Lung	Colon	RES	Prostate	Liver	LOTP	Cervix	Thyroid	Stomach	TOTAL
2012	832	1,339	1,568	1,628	1,022	1,192	930	644	994	1,392	11,540
2014	865	1,403	1,677	1,779	1,008	1,189	690	791	1,114	1,662	12,178
2016	823	1,303	1,651	1,596	738	1,339	1,016	390	688	1,450	10,992
2018	798	1,311	1,579	1,588	946	1,140	1,040	283	842	1,612	11,140
2020	799	1,275	1,460	1,477	1,035	1,193	1,171	496	931	1,123	10,960
2022	832	1,339	1,568	1,628	1,022	1,191	930	644	994	1,392	11,540
2024	834	1,259	1,591	1,578	929	1,209	956	474	854	1,306	10,990
2026	818	1,335	1,597	1,634	974	1,160	948	508	927	1,578	11,478
2028	817	1,306	1,541	1,561	970	1,222	1,043	509	919	1,296	11,184
2030	837	1,281	1,581	1,613	1,024	1,139	896	495	937	1,381	11,184

^dUnable to perform off-island projections due to inadequate available data

Table 2 illustrates an 18-year (2012-2030) combined projected outpatient and inpatient Physician's Charges per patient per year and the over-all cost for these 10 cancer types. Total projected physician's charges for breast cancer for instance for on-island medical services was estimated at \$823 per patient in 2016. For the same year, the estimated total amount for Physician's Charges for the 10 cancer types was \$10,992. It is important to note that the projected costs did not follow a linear relationship and was dependent on the actual yearly prevalence rate, projected yearly prevalence rates of each cancer type, the actual and adjusted physician's charges and the type and cost of actual medical services where the projections were based upon.

**Table 3. Projected^d Combined Outpatient-Inpatient Physician's Charges
by Cancer Type, 2012-2030 (in US\$)**

Year	Cancer Type										
	Breast	Lung	Colon	RES	Prostate	Liver	LOTP	Cervix	Thyroid	Stomach	TOTAL
2012	18,581	24,543	22,481	18,449	12,260	9,929	8,994	3,863	6,959	6,496	132,553
2014	11,648	27,220	24,049	17,364	10,217	11,915	5,583	3,648	4,97	7,424	124,037
2016	16,085	29,897	27,186	24,418	11,238	14,298	7,754	6,867	6,959	8,816	153,517
2018	17,638	29,600	25,095	27,674	11,238	14,828	8,270	5,794	6,959	8,352	155,447
2020	15,438	27,964	25,095	24,418	12,601	14,033	8,580	6,151	5,964	6,960	147,204
2022	15,123	27,220	25,095	19,534	11,238	12,047	7,443	4,792	5,964	6,960	135,418
2024	16,177	28,906	25,095	22,790	11,238	13,680	7,202	5,436	5,964	8,352	144,841
2026	15,281	29,153	23,526	26,046	11,238	14,386	8,201	6,271	6,957	8,352	149,413
2028	13,395	28,261	25,095	24,418	12,260	13,636	8,098	5,579	5,964	6,960	143,666
2030	13,728	27,715	25,752	25,232	12,938	12,757	6,952	5,458	6,110	7,436	144,078

^d Unable to perform off-island projections due to inadequate available data

Table 3 is an 18-year (2012-2030) combined projected outpatient and inpatient Physician's Charges per cancer type per year and the over-all cost for these 10 cancer types. Total physician's charge for breast cancer alone for on-island medical services was estimated at \$16,084.8 in 2016. For the same year, \$133,464 was the projected total cost for Physician's Charges for the 10 cancer types. The projected costs did not follow a linear relationship. For Reticulo-Endothelial System Cancers which has the highest inpatient physician's charge among the 10 cancer types, in 2018, the over-all projected physician's charge is at \$27,674.

**Table 4. Projected^d Combined Outpatient-Inpatient Insurance Payment
by Cancer Type, 2012-2030 (in US\$)**

Year	Cancer Type										
	Breast	Lung	Colon	RES	Prostate	Liver	LOTP	Cervix	Thyroid	Stomach	TOTAL
2012	9,701	10,389	12,081	8,926	2,151	5,450	4,480	2,984	3,551	6,309	66,021
2014	6,081	11,522	12,924	8,401	1,792	6,540	2,780	2,818	2,537	7,210	62,605
2016	8,398	12,655	14,609	11,814	1,972	7,848	3,862	5,305	3,551	8,562	78,576
2018	9,208	12,529	13,486	13,389	1,972	8,139	4,119	4,476	3,551	8,111	78,980.5
2020	8,060	11,837	13,486	11,814	2,211	7,703	4,274	4,753	3,044	6,759	73,938.5
2022	7,896	11,522	13,486	9,451	1,972	6,613	3,707	3,703	3,044	6,759	68,151
2024	8,446	12,235	13,486	11,026	1,972	7,509	3,587	4,200	3,044	8,111	73,616
2026	7,978	12,340	12,643	12,601	1,972	7,897	4,085	4,845	3,551	8,111	76,022
2028	6,993	11,962	13,486	11,814	2,151	7,485	4,034	4,310	3,044	6,759	72,038
2030	7760	12,228	14,677	12,059	2474	8,476	4,457	4,657	3,332	6936	77,058

^d Unable to perform off-island projections due to inadequate available data

Table 4 is an 18-year (2012-2030) combined projected outpatient and inpatient Insurance Payment per cancer type per year and the over-all cost for these 10 cancer types. Total projected Medicaid-MIP Payment for breast cancer on-island medical services was estimated at \$ 8,398 in 2016. For the same year, Medicaid-MIP is projected to spend \$ 78,576 in government insurance payment for the 10 cancer types. Once again, the projected costs do not follow a linear relationship.

Discussion

The National Vital Statistics Reports of the CDC listed Malignant Neoplasms to be the second cause of death in United States. Diseases of the heart ranked first in the list (3). Similarly in Guam, cancer ranked 2nd among the non-communicable causes of death in 2007 (4).

To date, no study on the economic cost of NCDs on Guam exists. However, the Department of Public Health and Social Services Bureau of Health Care Finance Administration provided information on expenditures incurred by the Government of Guam's Medically Indigent Program (MIP) and Medicaid program for enrollees composed mainly of economically disadvantaged individuals and families. The data shows that close to \$3 million was expended for cancer as a primary diagnosis in FY 2010 (4). In this particular study, the projected direct medical cost of the 10 leading cancer for 2012 using physician's charges as the basis was at \$132,553. Cost of in-patient services are generally higher and Medicaid-MIP reimbursements for in-patient services are 50% of physician's charges (10). It would have been of interest to compare these figures with similar data from different state-run insurances. However, the lack of published data makes the comparison difficult.

Guam, being an island posts a unique characteristic to the health seeking attitude of local residents. Those with enough financial resources fly off island for better diagnostic and or treatment modalities. Although created for the economically disadvantaged individuals and families, the Medicaid-MIP insurance system in Guam covers for medical service expenses acquired off-island. This gives them the chance to obtain more advanced medical care which translates to improved survival rate.

Analytical approaches to assess economic cost continue to evolve as a science. Three basic methodological elements are necessary namely: data availability, costs definition and epidemiological measures. This study utilized health insurance claims record from the Bureau of Health Financing. This is consistent with most economic cost studies conducted in United States where Medicare claims records are used solely or in tandem with individual hospital records of patients. In Korea for instance, NHIC claims records were used to estimate the direct costs of the major cancers associated with smoking. The NHIC is the exclusive insurer of the Korean social health insurance system, and NHIC claims records represent medical care covered by the Korean insurance program (6).

Limitations:

1. Source of data.
 - a. Public insurance claims data which mostly reflect direct medical costs was used in the analysis which could be an underestimation of the real cost of care. It would have been more accurate to engage the participation of private insurance agencies since patients are inclined to use their coverage to defray the costs of services. Their inclusion would have made a better projection. However, due to the sensitive nature of information needed for the study, most private insurance agencies declined participation.
2. Completeness of the data.
 - a. Some data on off-island costs were inadequate making projection analysis difficult or impossible.
 - b. Only primary cancer diagnoses were analyzed. Information on organ metastasis and tumor stage was not available. Moreover, this study only reflected direct medical cost of care and did not include, due to the source of the data being secondary, indirect costs of care.
 - c. Inherent difficulty: missing variables from the data set: Stage of cancer at the time of diagnosis; purpose of service whether for screening, treatment, follow-up, palliative, etc.
3. Analytical Procedure. There are limitations in the use of the projected population.
 - a. First, in using the projected population, incidence of cases are being measured and thus this may have led to underestimation of the burden of cancer and the costs estimates. Unlike the retrospective data from which the cancer costs and prevalence were calculated, there are cases that are carried over from the year of cancer onset to the remaining years (provided they are still sick and have not been fully treated or have died).
 - b. Second, the actual costs from which moving averages were computed were from the Medicaid-MIP population and not the total population of Guam. This may also have reduced the projected costs estimates and the burden of cancer.

Recommendations

1. Although this study is limited to represent only Medicaid-MIP participants and therefore the corresponding Medicaid-MIP Insurance coverage, the results could serve as basis and guide to policy makers and the Cancer Prevention Program in enhancing efforts and to support activities towards prevention and control of cancer in Guam.
2. Do a follow up cost analysis study focusing on each type of cancer and existing comorbidities utilizing hospital records; clinic records; histopathologic reports, focus group discussions of cancer survivors, current patients, caregivers to gain more in-depth understanding on the direct and indirect cost of cancer care in Guam.
3. Enhance data quality and recording by including Tumor/Cancer Stage and Metastasis to facilitate analysis of medical service costs.
4. Enhance sharing of information between the Cancer Registry and BHF Cancer Data by possibly creating a unique record link to facilitate future cost analysis.

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